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COMPLETED

FLOOD INSURANCE STUDY

ORIGINAL

TOWN OF SHADY SHORES, TEXAS
DENTON COUNTY

APRIL 15, 1986

Federal Emergency Management Agency

COMMUNITY NUMBER - 481135

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PUBLISHED SEPARATELY:

Flood Insurance Rate Map

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FLOOD INSURANCE STUDY
TOWN OF SHADY SHORES, TEXAS

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the Town of Shady Shores, Denton County, Texas, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in their efforts to promote sound flood plain management. Minimum flood plain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses in this study represent a revision of the original analyses by Michael Baker, Jr., Inc., for the Federal Emergency Management Agency (FEMA). The updated version was prepared by the Fort Worth District of the U. S. Army Corps of Engineers (COE) for FEMA, under Inter-Agency Agreement No. EMW-E-0941, Project Order No. 12. This study was completed in January 1984. The hydrologic and hydraulic analyses in the updated study were performed by the COE.

1.3 Coordination

On August 17, 1982, the community base map was selected and streams requiring detailed study were identified at an initial Consultation and Coordination Officer's (CCO) meeting attended by representatives of FEMA, the Town of Shady Shores, and the COE (the study contractor).

On February 15, 1985, the results of the study were reviewed at a final CCO meeting held with representatives of FEMA, the town, and the study contractor.

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2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the Town of Shady Shores, Denton County, Texas. The area of study is shown on the Vicinity Map (Figure 1).

The following flooding sources were studied by detailed methods within the community: Lynchburg Creek, Stream LC-1, Stream PEC-1, and Lewisville Lake. The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development and proposed construction through January 1989.

A portion of Stream LC-1 and an unnamed tributary south of Lynchburg Creek were studied by approximate methods. Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA and the Town of Shady Shores.

2.2 Community Description

The Town of Shady Shores is located in north central Texas in the southeast portion of Denton County. It is situated approximately 27 miles north of downtown Dallas on the west side of Lewisville Lake. Shady Shores is bordered by the City of Lake Dallas to the south, the Town of Corinth to the west and south, and the unincorporated areas of Denton County to the north and west. According to U. S. Census Bureau figures, the population in 1980 was 913 (References 1 and 2). The land area contained within the corporate limits of Shady Shores is approximately 2.6 square miles. Lewisville Lake is on the east side of the community.

Lynchburg Creek flows from west to east into Lewisville Lake in the southern portion of the town. It is approximately 2.1 stream miles long and has a drainage area of approximately 3.7 square miles. Only approximately 0.8 stream mile has an effect within the community.

Stream LC-1 flows southeast through the Town of Shady Shores into Lynchburg Creek. The portion of this creek that has a result in the town is approximately 1.8 stream miles long. This stream has a drainage area of approximately 1.3 square miles.

Stream PEC-1 flows from west to east into Pecan Creek in the northern portion of the town. It is approximately 4.1 stream miles long and has a drainage area of approximately 4.1 square miles. Only approximately 1.0 stream mile has an effect within the Town of Shady Shores.

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The climatological data at Fort Worth are considered indicative of the conditions prevailing in the region. Average rainfall is 32.30 inches for the last 10-year period. The maximum and minimum annual rainfall occurring during the last 57 years was 51.03 inches in 1932 and 17.91 inches in 1921, respectively. The mean relative humidity is 65 percent, and the average temperature is 65.8 degrees Fahrenheit (Reference 3).

2.3 Principal Flood Problems

Generally, the major floods experienced in the vicinity are produced by heavy rainfall from frontal type storms which occur in the spring and summer months. Major flooding can be produced by the intense rainfall usually associated with localized thunderstorms. These thunderstorms may occur at any time during the year but are more prevalent in the spring and summer months.

No formal documented history of flooding within the community was found; however, some minor localized flooding has been reported along Stream LC-1 above Shady Shores Road. Portions of the town would be inundated from large floods.

2.4 Flood Protection Measures

Nonstructural measures of flood protection in the form of land use regulations and ordinances are being used to aid in the prevention of future flood damage.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

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3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each flooding source studied in detail affecting the community.

The computer program NUDALLAS was used in developing the hydrology for the streams studied by detailed methods (Reference 4). The watershed was divided into subareas, and synthetic unit and flood hydrographs were developed at selected locations. Weather Bureau Technical Paper No. 40 and National Oceanic and Atmospheric Administration Technical Memorandum NWS Hydro-35 were used in developing the 10-, 50-, and 100-year frequency storms (References 5 and 6). The 500-year storm was based on extrapolated data. Peak discharge-frequency values were computed for selected locations. Routing of the flood hydrographs through each subbasin reach was accomplished using a modified Puls reservoir routing method. The HEC-2 step-backwater model provided the elevation-discharge-storage relationships for each reach on Lynchburg Creek, Stream LC-1, and Stream PEC-1 (Reference 7).

A summary of drainage area-peak discharge relationships for the streams studied by detailed methods is shown in Table 1, "Summary of Discharges."

TABLE 1 - SUMMARY OF DISCHARGES

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
LYNCHBURG CREEK					
At South Shady Shores Road	3.65	3,250	4,500	5,100	6,500
Approximately 250 feet upstream of South Shady Shores Road	2.33	1,750	2,450	2,800	3,750
STREAM LC-1					
At confluence with Lynchburg Creek	1.32	1,600	2,200	2,460	3,050
STREAM PEC-1					
Immediately upstream of confluence with Pecan Creek	4.12	2,700	4,400	5,100	6,250
Below confluence with branch near Shiloh Cemetery	2.97	2,500	4,000	4,550	5,400

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TABLE 1 - SUMMARY OF DISCHARGES - continued

FLOODING SOURCE AND LOCATION	DRAINAGE AREA (sq. miles)	PEAK DISCHARGES (cfs) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
STREAM PEC-1 - continued					
Above confluence with branch near Shiloh Cemetery	2.48	2,050	3,350	3,850	4,500
At dam upstream of I-35E[1]	1.75	1,500	2,650	3,000	3,700
Area above Unicorn Lake[1]	0.83	1,250	1,700	1,900	2,300

[1]Located upstream of corporate limits

The stillwater elevations for the 10-, 50-, 100-, and 500-year floods have been determined for Lewisville Lake and are shown in Table 2.

TABLE 2 - SUMMARY OF STILLWATER ELEVATIONS

FLOODING SOURCE AND LOCATION	ELEVATION (feet) 10-YEAR	50-YEAR	100-YEAR	500-YEAR
LEWISVILLE LAKE	529.5	535.0	537.0	541.0

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Cross sections for the backwater analyses of the streams studied by detailed methods were field surveyed. Cross sections were located at close intervals above and below bridges and culverts in order to compute the significant backwater effects of these structures.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

Channel roughness factors (Manning's "n") used in the hydraulic computations were assigned on the basis of field inspection of flood plain areas and by engineering judgment. The following tabulation shows the channel and overbank "n" values for the streams studied by detailed methods. This range of roughness values does not reflect the values used at the bridges for the channel or overbanks.

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Stream	Channel "n"	Overbank "n"
Lynchburg Creek	0.050-0.070	0.075-0.090
Stream LC-1	0.040	0.055-0.060
Stream PEC-1	0.055-0.060	0.060-0.070

Water-surface elevations of floods of the selected recurrence intervals for the streams studied by detailed methods were computed using the COE HEC-2 step-backwater computer program (Reference 7). Flood profiles were drawn showing computed water-surface elevations for floods of the selected recurrence intervals. Starting water-surface elevations were calculated using the slope/area method.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages State and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study produces maps designed to assist communities in developing flood plain management measures.

4.1 Flood Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for flood plain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year flood plain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps (Reference 8). Portions of the flood boundaries along Lewisville Lake were delineated using COE real estate maps (Reference 9).

For the streams studied by approximate methods, only the 100-year flood plain boundary has been shown. The approximate boundary was delineated using the previously effective Flood Insurance Study for the Town of Shady Shores (Reference 10).

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The 100- and 500-year flood plain boundaries are shown on the Flood Boundary and Floodway Map (Exhibit 2). In cases where the 100- and 500-year flood plain boundaries are close together, only the 100-year flood plain boundary has been shown. Small areas within the flood plain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

4.2 Floodways

Encroachment on flood plains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood plain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent flood plain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the flood plain. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 3).

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway boundaries were computed at cross sections. Between cross sections, the boundaries were interpolated. In cases where the floodway and 100-year flood plain boundaries are either close together or collinear, only the floodway boundary has been shown. Floodways were not delineated within the government fee and/or flowage easement boundary since the COE flood plain regulations are more restrictive. Portions of the floodway widths for Stream LC-1 and Stream PEC-1 extend beyond the corporate limits.

The area between the floodway and 100-year flood plain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain developments are shown in Figure 2.

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Lynchburg Creek								
A	14,800[2]	*	*	*	537.0	537.0	537.7	0.7
Stream LC-1								
A	3,070[3]	*	*	*	538.8	538.8	539.0	0.2
B	4,760[3]	100	581	4.2	544.3	544.3	545.3	1.0
C	6,410[3]	186	712	3.4	555.1	555.1	555.8	0.7
D[1]	7,940[3]	190[4]	715	3.4	559.8	559.8	560.8	1.0

[1]Located outside corporate limits

[2]Feet above confluence with Lewisville Lake

[3]Feet above confluence with Lynchburg Creek

[4]This width extends beyond corporate limits

*Floodway within Government Property - Fee and/or Flowage Easement

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF SHADY SHORES, TX

(DENTON CO.)

FLOODWAY DATA

LYNCHBURG CREEK-STREAM LC-1

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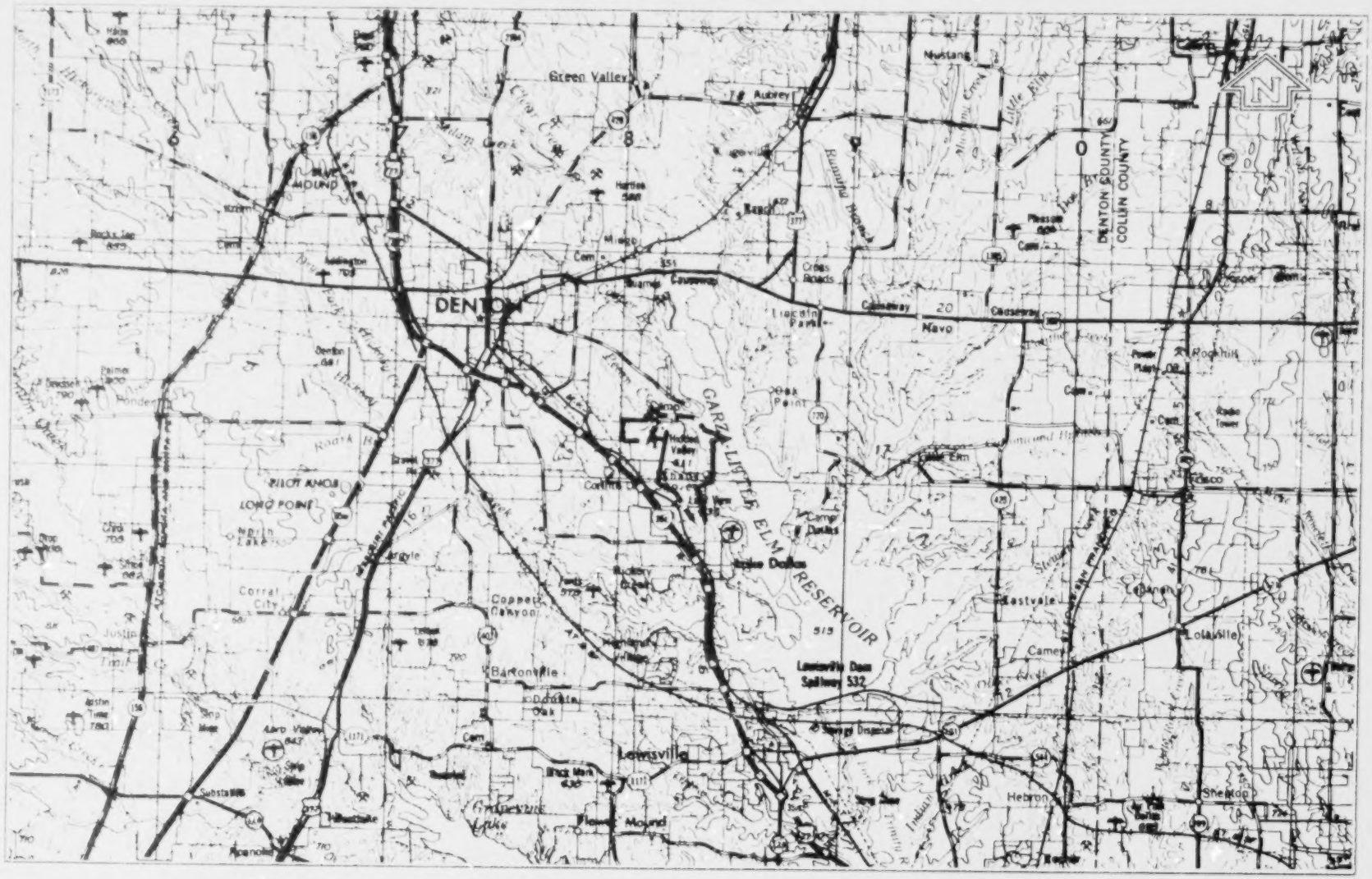

FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF SHADY SHORES, TX

(DENTON CO.)

APPROXIMATE SCALE

4 0 4 8 12 MILES

VICINITY MAP

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FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Stream PEC-1								
A	12,000	350/40	1,290	3.5	550.3	550.3	551.1	0.8

[1]Feet above confluence with Pecan Creek

[2]Width/width within corporate limits

TABLE 3

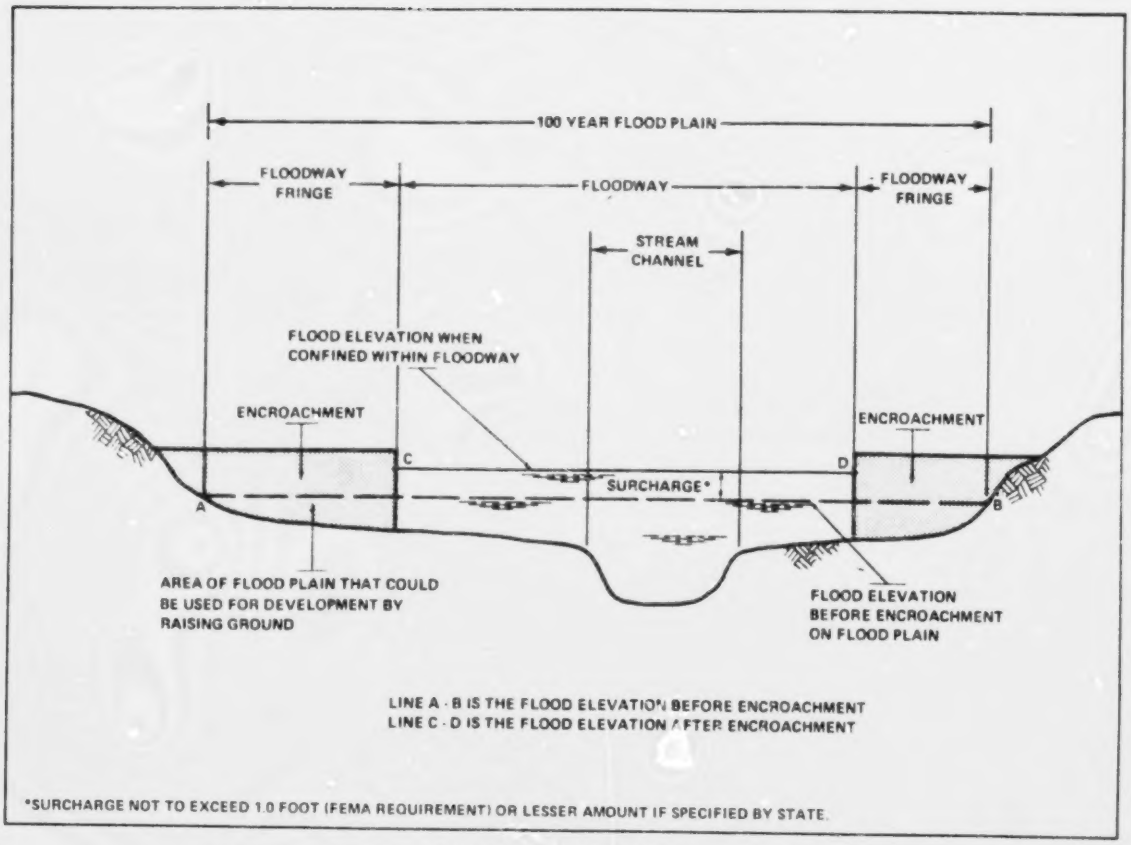
FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF SHADY SHORES, TX

(DENTON CO.)

FLOODWAY DATA

STREAM PEC-1


100 YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN
LINE A - B IS THE FLOOD ELEVATION BEFORE ENCROACHMENT
LINE C - D IS THE FLOOD ELEVATION AFTER ENCROACHMENT
*SURCHARGE NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

FLOODWAY SCHEMATIC Figure 2

5.0 INSURANCE APPLICATION

To establish actuarial insurance rates, data from the engineering study must be transformed into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors, and flood insurance zone designations for each flooding source studied in detail in the Town of Shady Shores.

5.1 Reach Determinations

Reaches are defined as sections of flood plain that have relatively the same flood hazard, based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference may not have a variation greater than that indicated in the following tabulation for more than 20 percent of the reach:

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Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the flooding sources of the Town of Shady Shores are shown on the Flood Profiles (Exhibit 1) and summarized in Table 4.

5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is used to establish relationships between depth and frequency of flooding in any reach. This relationship is then used with depth-damage relationships for various classes of structures to establish actuarial insurance rate tables.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations rounded to the nearest one-half foot, multiplied by 10, and shown as a three-digit code. For example, if the difference between water-surface elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year flood water-surface elevations is greater than 10.0 feet, it is rounded to the nearest whole foot.

5.3 Flood Insurance Zones

Flood insurance zones and zone numbers are assigned based on the type of flood hazard and the FHF, respectively. A unique zone number is associated with each possible FHF, and varies from 1 for a FHF of 005 to a maximum of 30 for a FHF of 200 or greater.

Zone A: Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or FHFs determined.

Zones A1, A2, A3, and A15: Special Flood Hazard Areas inundated by the 100-year flood; with base flood elevations shown, and zones subdivided according to FHFs.

Zone B: Areas between the Special Flood Hazard Areas and the limits of the 500-year flood; areas that are protected from the 100- or 500-year floods by dike,

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FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1.0% (100-YEAR) FLOOD AND			FHF	ZONE	BASE FLOOD ELEVATION[3] (NGVD)
		10% (10 YR.)	2% (50 YR.)	0.2% (500 YR.)			
Lynchburg Creek Reach 1	01	-1.1	-0.3	+0.7	010	A2	Varies
Stream LC-1 Reach 1	01	-0.6	-0.2	+0.4	005	A1	Varies
Stream PEC-1 Reach 1	01	-1.3	-0.3	+0.4	015	A3	Varies
Lewisville Lake	01	-7.5	-2.0	+4.0	075	A15	537

[1]Flood Insurance Rate Map Panel
[2]Weighted Average
[3]Rounded to the nearest foot - see Map

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY
Federal Insurance Administration
TOWN OF SHADY SHORES, TX
(DENTON CO.)

FLOOD INSURANCE ZONE DATA

LYNCHBURG CREEK-STREAM LC-1-STREAM PEC-1-LEWISVILLE LAKE

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Zone B: (continued)	levee, or other water control structure; areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.
Zone C:	Areas of minimal flooding; not subdivided.

Flood elevation differences, FHFs, flood insurance zones, and base flood elevations for the flooding sources studied in detail in the community are shown in Table 4.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the Town of Shady Shores is, for insurance purposes, the principal result of the Flood Insurance Study. This map contains the official delineation of flood insurance zones and base flood elevations. Base flood elevation lines show the locations of the expected whole-foot water-surface elevation of the base (100-year) flood. The base flood elevations and zone numbers are used by insurance agents, in conjunction with structure elevations and characteristics, to assign actuarial insurance rates to structures and contents insured under the National Flood Insurance Program.

6.0 OTHER STUDIES

Flood Insurance Studies for the unincorporated areas of Denton County, the Town of Corinth, and the City of Lake Dallas are currently being prepared (References 11, 12, and 13). The results of those studies will be in exact agreement with the results of this study for Shady Shores.

This Flood Insurance Study supersedes the previously effective study for Shady Shores (Reference 10).

7.0 LOCATION OF DATA

Information concerning the pertinent data used in preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, Federal Emergency Management Agency, Regional Director, Region VI Office, Federal Center, Denton, Texas 76201.

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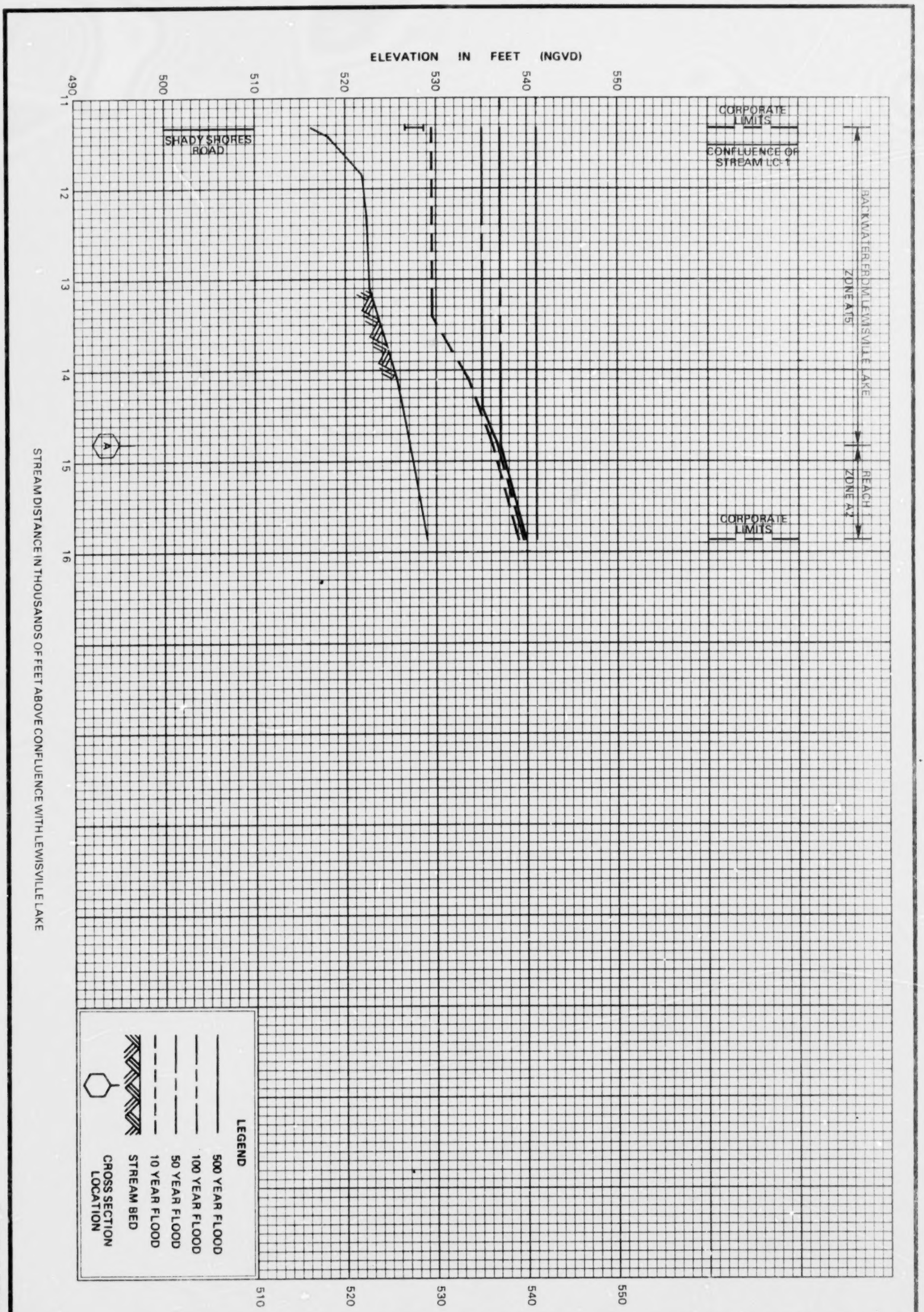

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF SHADY SHORES, TX

(DENTON CO.)

FLOOD PROFILES

LYNCHBURG CREEK

01P

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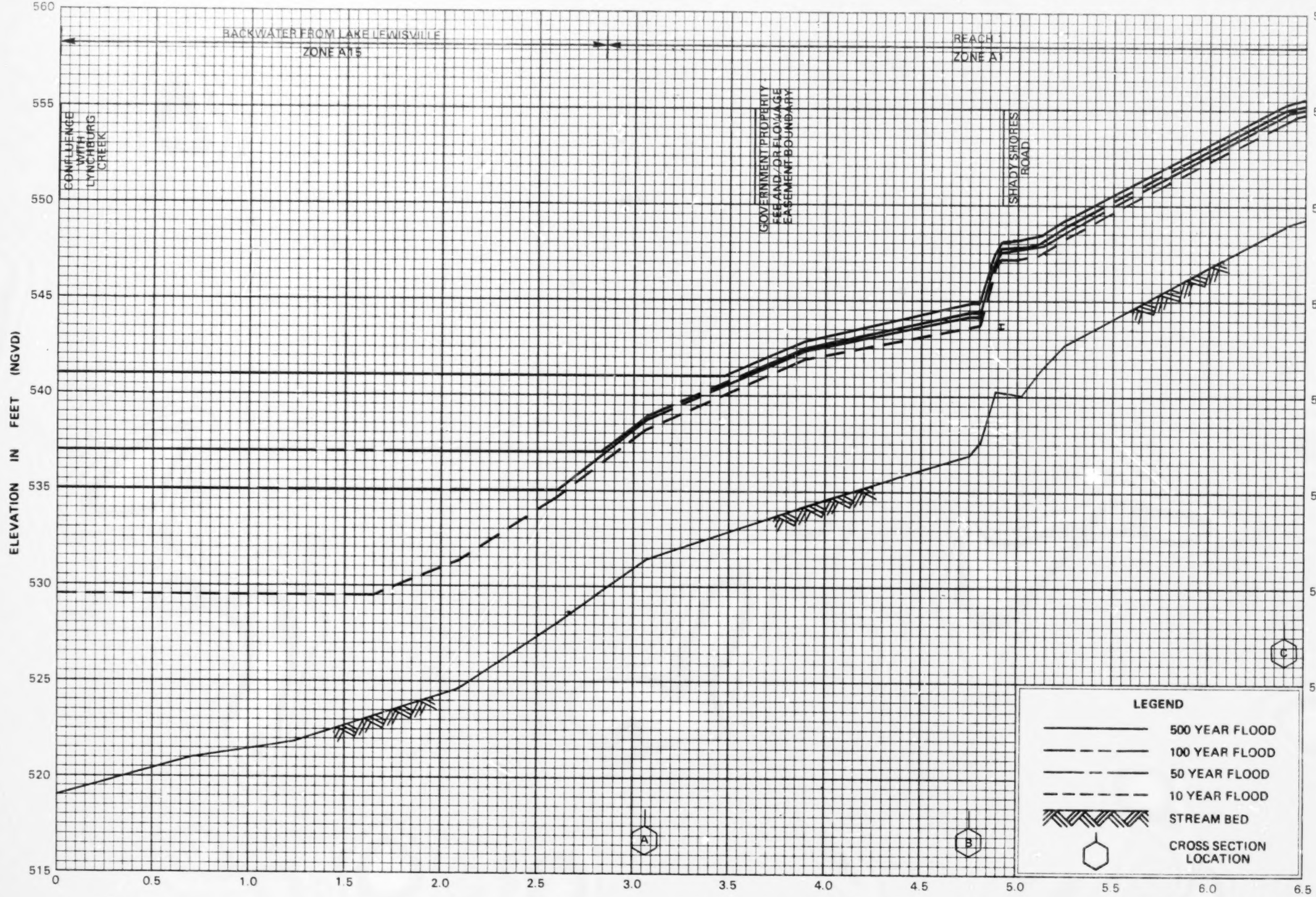

FLOOD PROFILES

STREAM LC-1

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF SHADY SHORES, TX
(DENTON CO.)

02P

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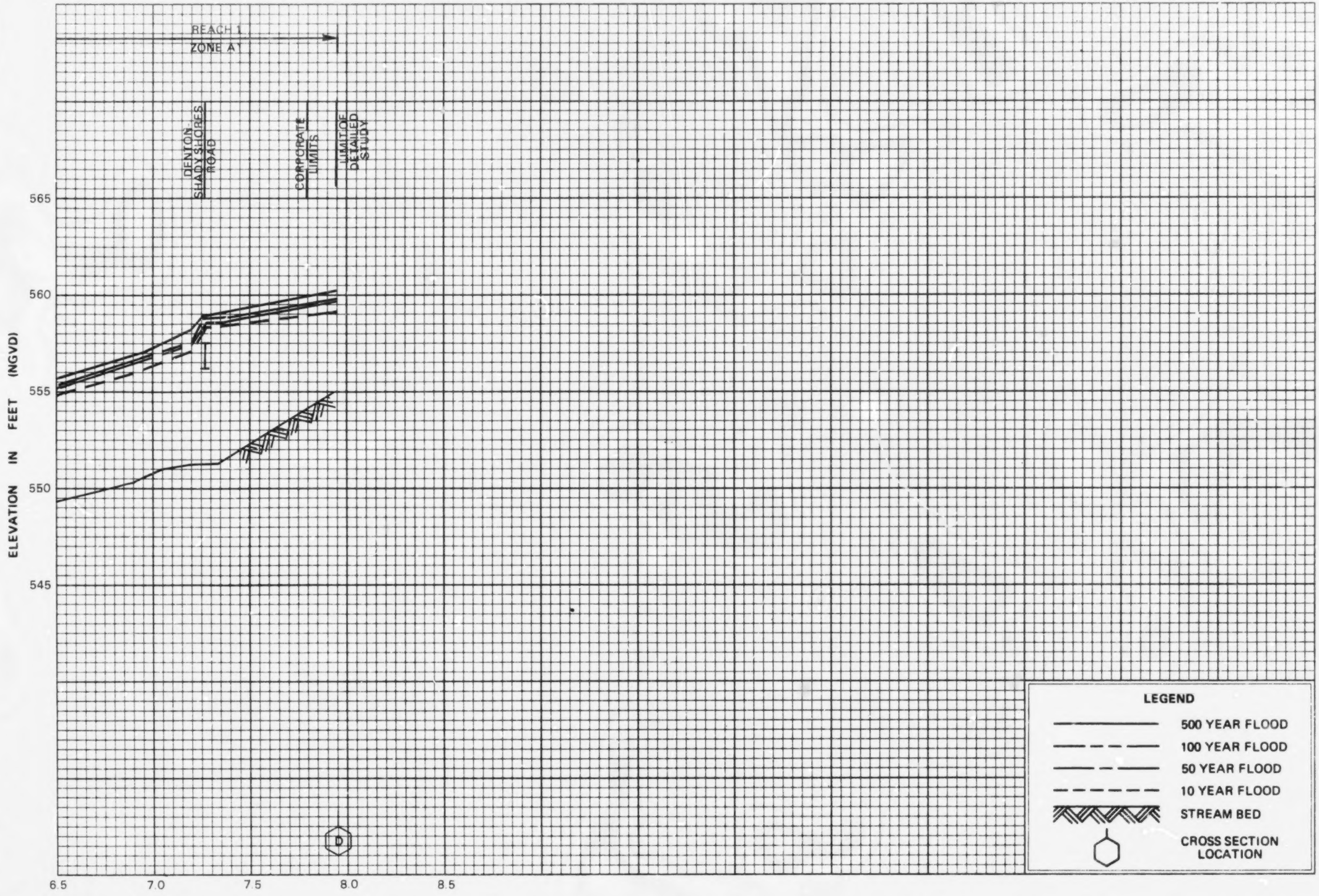

FLOOD PROFILES

STREAM LC-1

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF SHADY SHORES, TX
(DENTON CO.)

03P

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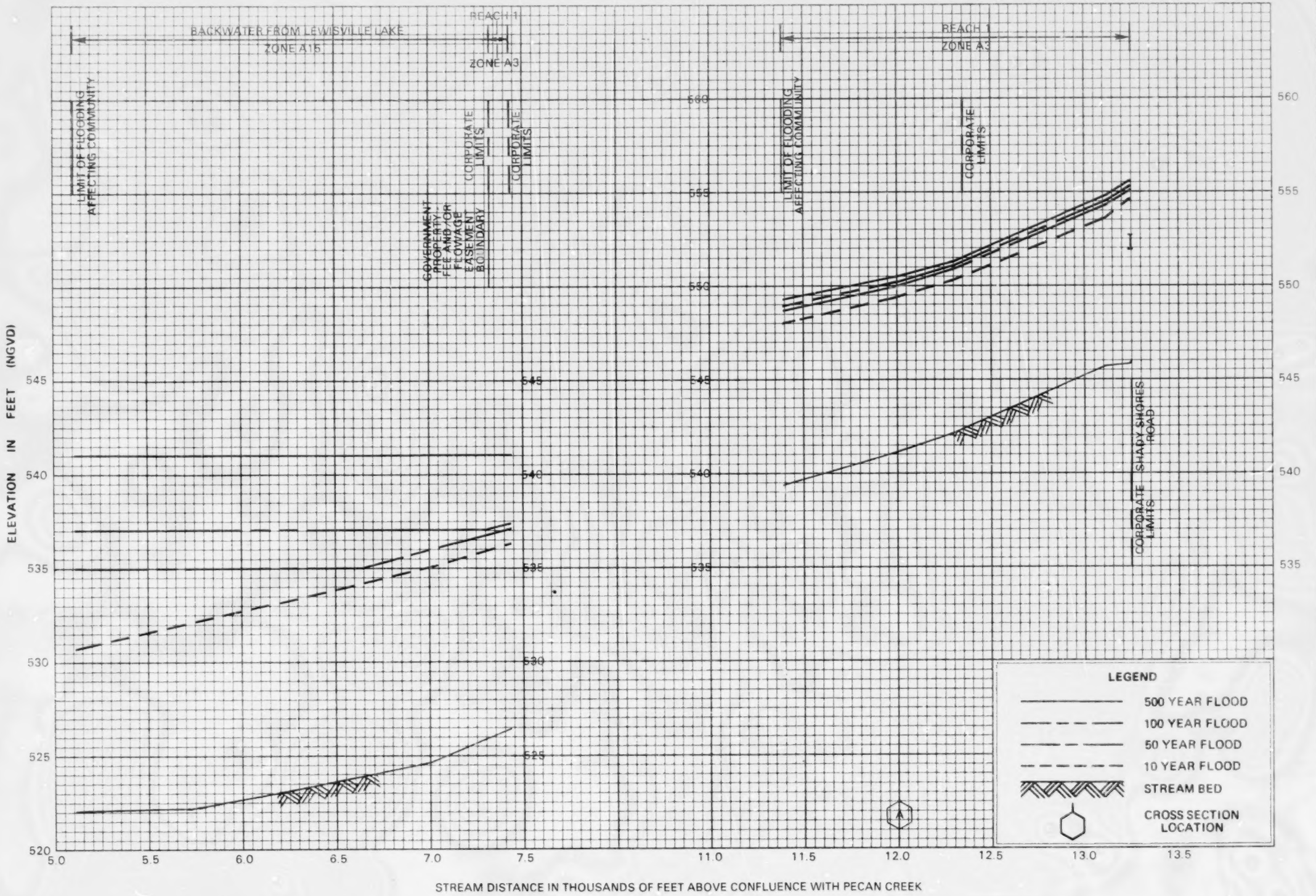

FLOOD PROFILES

STREAM PEC-1

FEDERAL EMERGENCY MANAGEMENT AGENCY

TOWN OF SHADY SHORES, TX
(DENTON CO.)

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